

IN THE CLAIMS:

Please amend the claims as follows.

1. (Previously Presented) The optical head of claim 52, wherein the plurality of wavelengths comprises a first wavelength and a second wavelength that is approximately twice as long as the first wavelength;

wherein the first diffraction light is substantially a second-order diffraction light with respect to the beam with the first wavelength and the second diffraction light is substantially a first-order diffraction light with respect to the beam with the second wavelength.

2. (Original) The optical head according to claim 1, wherein said at least one diffractive optical element has a cross section substantially of a sawtooth shape, and with respect to the first wavelength  $\lambda_1$ , the second wavelength  $\lambda_2$ , and a refractive index  $n$  of a material of said at least one diffractive optical element, groove depth in the sawtooth shape is substantially in a range between  $2\lambda_1 / (n-1)$  and  $\lambda_2 / (n-1)$  in the case of a transmission element, is substantially in a range between  $\lambda_1 / n$  and  $\lambda_2 / 2n$  in the case of a reflection element onto which beams are incident from a substrate side, and is substantially in a range between  $\lambda_1$  and  $\lambda_2 / 2$  in the case of a reflection element onto which beams are incident from an air side.

3. (Original) The optical head according to claim 1, wherein said at least one diffractive optical element is an objective lens for focusing beams on an information recording medium.

4. (Original) The optical head according to claim 1, wherein said at least one diffractive optical element is a collimator lens for collimating beams emitted from said at least one light source substantially into parallel beams.
5. (Original) The optical head according to claim 1, wherein said at least one diffractive optical element is a focusing/tracking error signal detection element.
6. (Original) The optical head according to claim 1, wherein with respect to the first wavelength  $\lambda_1$ , a minimum period  $\Lambda_{\min}$  of said at least one diffractive optical element satisfies a relationship of  $\Lambda_{\min} \geq 10\lambda_1$ .
7. (Original) The optical head according to claim 1, wherein with respect to the first wavelength  $\lambda_1$ , a minimum period  $\Lambda_{\min}$  of the diffractive optical element satisfies a relationship of  $\Lambda_{\min} \geq 22\lambda_1$ .
8. (Original) The optical head according to claim 1, wherein the optical head further comprises a refraction optical element having optical surfaces onto which beams emitted from said at least one light source are incident obliquely, the refraction optical element is provided in optical paths of the beams with the first and the second wavelengths, and a diffraction angle of light diffracted by said at least one diffractive optical element due to variation in wavelength of the beams emitted from said at least one light source and a refraction angle of light refracted by the refraction optical element are changed in

directions that enable the beams to be canceled out with each other.

9. (Original) The optical head according to claim 8, wherein said at least one diffractive optical element is a grating with a uniform period.

10. (Original) The optical head according to claim 8, wherein said at least one diffractive optical element is positioned in a converging light optical path or a diverging light optical path with a numerical aperture of 0.39 or less, and said at least one diffractive optical element has a uniform period.

11. (Original) The optical head according to claim 8, wherein the refraction optical element is a prism with three optical surfaces, and when in the three optical surfaces, a surface on a side of an information recording medium is a first surface, a surface on a side of said at least one light source is a second surface, and a surface other than those is a third surface, the refraction optical element is designed so that the beams emitted from said at least one light source pass through the second surface, are reflected by the first and the third surfaces sequentially, and then pass through the first surface, and a bottom part of an objective lens is located lower than a highest position of the beams entering the second surface that have been emitted from said at least one light source.

12. (Original) The optical head according to claim 11, wherein a glass material of the prism has an Abbe number of at least 64.

13. (Original) The optical head according to claim 1, wherein said light source is an SHG light source that emits beams with two wavelengths.

14. (Original) The optical head according to claim 1, wherein the optical head further comprises a transparent substrate in which the beams with the first and the second wavelengths propagate in a zigzag manner, and said at least one diffractive optical element is positioned on the transparent substrate.

15. (Original) The optical head according to claim 1, wherein the first wavelength  $\lambda_1$  satisfies a relationship of  $0.35\mu\text{m} \leq \lambda_1 \leq 0.44\mu\text{m}$  or the second wavelength  $\lambda_2$  satisfies a relationship of  $0.76\mu\text{m} \leq \lambda_2 \leq 0.88\mu\text{m}$ .

16. (Original) The optical head according to claim 1, wherein the first wavelength  $\lambda_1$  satisfies substantially a relationship of  $0.35\mu\text{m} \leq \lambda_1 \leq 0.44\mu\text{m}$ , and said at least one diffractive optical element is a chromatic-aberration compensation element for compensating chromatic aberration caused by an objective lens for focusing beams on an information recording medium.

17. (Previously Presented) The optical head of claim 52, further comprising an objective lens for focusing beams on an information recording medium; and wherein the plurality of wavelengths comprises a first wavelength and a second wavelength that is approximately twice as long as the first wavelength;  
wherein the diffractive optical element is a chromatic-aberration compensation

element that compensates chromatic aberration caused by the objective lens and that has difference in level of a step-like shape or grooves substantially of a sawtooth shape, and with respect to the first wavelength  $\lambda_1$ , the second wavelength  $\lambda_2$ , and a refractive index n of a material of the chromatic-aberration compensation element, the difference in level or depth of the grooves is in a range substantially between  $2\lambda_1 / (n-1)$  and  $\lambda_2 / (n-1)$ .

18. (Original) The optical head according to claim 17, wherein the first wavelength  $\lambda_1$  satisfies a relationship of  $0.35\mu\text{m} \leq \lambda_1 \leq 0.44\mu\text{m}$  or the second wavelength  $\lambda_2$  satisfies a relationship of  $0.76\mu\text{m} \leq \lambda_2 \leq 0.88\mu\text{m}$ .

19. (Original) The optical head according to claim 17, wherein the chromatic-aberration compensation element is formed on the objective lens.

20. (Original) The optical head according to claim 17, wherein the chromatic-aberration compensation element and the objective lens are driven together by an actuator.

21. (Original) The optical head according to claim 17, wherein the chromatic-aberration compensation element is a convex diffractive lens and forms converging light in cooperation with the objective lens.

22. (Previously Presented) The optical head of claim 52, wherein the plurality of wavelengths comprises a first wavelength, a second wavelength that is approximately

twice as long as the first wavelength, and a third wavelength that is approximately 1.5 times as long as the first wavelength;

wherein the first diffraction light is substantially a fourth-order diffraction light with respect to the beam with the first wavelength, the second diffraction light is substantially a second-order diffraction light with respect to the beam with the second wavelength, and a third diffraction light is substantially a third-order diffraction light with respect to the beam with the third wavelength.

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23. (Original) The optical head according to claim 22, wherein said at least one diffractive optical element has a cross section substantially of a sawtooth shape, and with respect to the first wavelength  $\lambda_1$ , the second wavelength  $\lambda_2$ , the third wavelength  $\lambda_3$ , and a refractive index  $n$  of a material of said at least one diffractive optical element, groove depth in the sawtooth shape is substantially in a range between a minimum and a maximum among  $4\lambda_1 / (n-1)$ ,  $2\lambda_2 / (n-1)$ , and  $3\lambda_3 / (n-1)$  in the case of a transmission element, is substantially in a range between a minimum and a maximum among  $2\lambda_1 / n$ ,  $\lambda_2 / n$ , and  $3\lambda_3 / 2n$  in the case of a reflection element onto which beams are incident from a substrate side, and is substantially in a range between a minimum and a maximum among  $2\lambda_1$ ,  $\lambda_2$ , and  $3\lambda_3 / 2$  in the case of a reflection element onto which beams are incident from an air side.

24. (Original) The optical head according to claim 22, wherein with respect to the first wavelength  $\lambda_1$ , a minimum period  $\Lambda_{\min}$  of said at least one diffractive optical element satisfies a relationship of  $\Lambda_{\min} \geq 22\lambda_1$ .

25. (Original) The optical head according to claim 22, wherein the first wavelength  $\lambda_1$  satisfies a relationship of  $0.35\mu\text{m} \leq \lambda_1 \leq 0.44\mu\text{m}$ , the second wavelength  $\lambda_2$  satisfies a relationship of  $0.76\mu\text{m} \leq \lambda_2 \leq 0.88\mu\text{m}$ , or the third wavelength  $\lambda_3$  satisfies a relationship of  $0.57\mu\text{m} \leq \lambda_3 \leq 0.68\mu\text{m}$ .

26. (Original) The optical head according to claim 22, wherein the first wavelength  $\lambda_1$  satisfies substantially a relationship of  $0.35\mu\text{m} \leq \lambda_1 \leq 0.44\mu\text{m}$ , and said at least one diffractive optical element is a chromatic-aberration compensation element for compensating chromatic aberration caused by an objective lens for focusing beams on an information recording medium.

27. (Previously Presented) The optical head of claim 52, further comprising an objective lens for focusing beams on an information recording medium; and wherein the plurality of wavelengths comprises a first wavelength a second wavelength that is approximately twice as long as the first wavelength, and a third wavelength that is approximately 1.5 times as long as the first wavelength; wherein said at least one diffractive optical element is a chromatic-aberration compensation element that compensates chromatic aberration caused by the objective lens and has difference in level of a step-like shape or grooves substantially of a sawtooth shape, and with respect to the first wavelength  $\lambda_1$ , the second wavelength  $\lambda_2$ , the third wavelength  $\lambda_3$ , and a refractive index  $n$  of a material of said at least one diffractive optical element, the difference in level or depth of the grooves is in a range between a

minimum and a maximum among  $4\lambda_1 / (n-1)$ ,  $2\lambda_2 / (n-1)$ , and  $3\lambda_3 / (n-1)$ .

28. (Original) The optical head according to claim 27, wherein the first wavelength  $\lambda_1$  satisfies a relationship of  $0.35\mu\text{m} \leq \lambda_1 \leq 0.44\mu\text{m}$ , the second wavelength  $\lambda_2$  satisfies a relationship of  $0.76\mu\text{m} \leq \lambda_2 \leq 0.88\mu\text{m}$ , or the third wavelength  $\lambda_3$  satisfies a relationship of  $0.57\mu\text{m} \leq \lambda_3 \leq 0.68\mu\text{m}$ .

29. (Original) The optical head according to claim 27, wherein the chromatic-aberration compensation element is formed on the objective lens.

30. (Original) The optical head according to claim 27, wherein the chromatic-aberration compensation element and the objective lens are driven together by an actuator.

31. (Original) The optical head according to claim 27, wherein the chromatic-aberration compensation element is a convex diffractive lens and forms converging light in cooperation with the objective lens.

32. (Previously Presented) The optical head of claim 52, wherein the plurality of wavelengths comprises a first wavelength and a second wavelength that is approximately 1.5 times as long as the first wavelength;

wherein the first diffraction light is substantially a third-order diffraction light with respect to the beam with the first wavelength and the second diffraction light is

substantially a second-order diffraction light with respect to the beam with the second wavelength.

33. (Original) The optical head according to claim 32, wherein said at least one diffractive optical element has a cross section substantially of a sawtooth shape, and with respect to the first wavelength  $\lambda_1$ , the second wavelength  $\lambda_2$ , and a refractive index  $n$  of a material of said at least one diffractive optical element, groove depth in the sawtooth shape is substantially in a range between  $3\lambda_1 / (n-1)$  and  $2\lambda_2 / (n-1)$  in the case of a transmission element, is substantially in a range between  $3\lambda_1 / 2n$  and  $\lambda_2 / n$  in the case of a reflection element onto which beams are incident from a substrate side, and is substantially in a range between  $3\lambda_1 / 2$  and  $\lambda_2$  in the case of a reflection element onto which beams are incident from an air side.

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34. (Original) The optical head according to claim 32, wherein with respect to the first wavelength  $\lambda_1$ , a minimum period  $\Lambda_{\min}$  of said at least one diffractive optical element satisfies a relationship of  $\Lambda_{\min} \geq 16\lambda_1$ .

35. (Original) The optical head according to claim 32, wherein the first wavelength  $\lambda_1$  satisfies a relationship of  $0.35\mu\text{m} \leq \lambda_1 \leq 0.44\mu\text{m}$  or the second wavelength  $\lambda_2$  satisfies a relationship of  $0.57\mu\text{m} \leq \lambda_2 \leq 0.68\mu\text{m}$ .

36. (Original) The optical head according to claim 32, wherein the first wavelength  $\lambda_1$  satisfies substantially a relationship of  $0.35\mu\text{m} \leq \lambda_1 \leq 0.44\mu\text{m}$ , and said at least one

diffractive optical element is a chromatic-aberration compensation element for compensating chromatic aberration caused by an objective lens for focusing beams on an information recording medium.

37. (Previously Presented) The optical head of claim 52, further comprising an objective lens for focusing beams on an information recording medium; and

wherein the plurality of wavelengths comprises a first wavelength and a beam with a second wavelength that is approximately 1.5 times as long as the first wavelength;

wherein the diffractive optical element is a chromatic-aberration compensation element that compensates chromatic aberration caused by the objective lens and that has difference in level of a step-like shape or grooves substantially of a sawtooth shape, and with respect to the first wavelength  $\lambda_1$ , the second wavelength  $\lambda_2$ , and a refractive index n of a material of the chromatic-aberration compensation element, the difference in level or depth of the grooves is substantially in a range between  $3\lambda_1 / (n-1)$  and  $2\lambda_2 / (n-1)$ .

38. (Original) The optical head according to claim 37, wherein the first wavelength  $\lambda_1$  satisfies a relationship of  $0.35\mu\text{m} \leq \lambda_1 \leq 0.44\mu\text{m}$  or the second wavelength  $\lambda_2$  satisfies a relationship of  $0.57\mu\text{m} \leq \lambda_2 \leq 0.68\mu\text{m}$ .

39. (Original) The optical head according to claim 37, wherein the chromatic-aberration compensation element is formed on the objective lens.

40. (Original) The optical head according to claim 37, wherein the chromatic-

aberration compensation element and the objective lens are driven together by an actuator.

41. (Original) The optical head according to claim 37, wherein the chromatic-aberration compensation element is a convex diffractive lens and forms converging light in cooperation with the objective lens.

42. (Previously Presented) The optical head of claim 52, wherein the plurality of wavelengths comprises a first wavelength, a second wavelength that is approximately twice as long as the first wavelength, and a third wavelength that is approximately 1.5 times as long as the first wavelength;

wherein the first diffraction light is substantially a sixth-order diffraction light with respect to the beam with the first wavelength, the second diffraction light is substantially a third-order diffraction light with respect to the beam with the second wavelength, and the third diffraction light is substantially a fourth-order diffraction light with respect to the beam with the third wavelength.

43. (Original) The optical head according to claim 42, wherein said at least one diffractive optical element has a cross section substantially of a sawtooth shape, and with respect to the first wavelength  $\lambda_1$ , the second wavelength  $\lambda_2$ , the third wavelength  $\lambda_3$ , and a refractive index  $n$  of a material of said at least one diffractive optical element, groove depth in the sawtooth shape is substantially in a range between a minimum and a maximum among  $6\lambda_1 / (n-1)$ ,  $3\lambda_2 / (n-1)$ , and  $4\lambda_3 / (n-1)$  in the case of a transmission

element, is substantially in a range between a minimum and a maximum among  $3\lambda_1 / n$ ,  $3\lambda_2 / 2n$ , and  $2\lambda_3 / n$  in the case of a reflection element onto which beams are incident from a substrate side, and is substantially in a range between a minimum and a maximum among  $3\lambda_1$ ,  $3\lambda_2 / 2$ , and  $2\lambda_3$  in the case of a reflection element onto which beams are incident from an air side.

44. (Previously Presented) The optical head of claim 52, further comprising an objective lens for focusing beams on an information recording medium; and

wherein the plurality of wavelengths comprises a first wavelength a second wavelength that is approximately twice as long as the first wavelength, and a third wavelength that is approximately 1.5 times as long as the first wavelength;

wherein said at least one diffractive optical element is a chromatic-aberration compensation element that compensates chromatic aberration caused by the objective lens and that has difference in level of a step-like shape or grooves substantially of a sawtooth shape, and with respect to the first wavelength  $\lambda_1$ , the second wavelength  $\lambda_2$ , the third wavelength  $\lambda_3$ , and a refractive index  $n$  of a material of said at least one diffractive optical element, the difference in level or depth of the grooves is substantially in a range between a minimum and a maximum among  $6\lambda_1 / (n-1)$ ,  $3\lambda_2 / (n-1)$ , and  $4\lambda_3 / (n-1)$ .

45. (Original) The optical head according to claim 44, wherein the chromatic-aberration compensation element is formed on the objective lens.

46. (Original) The optical head according to claim 44, wherein the chromatic-aberration compensation element and the objective lens are driven together by an actuator.

47. (Original) The optical head according to claim 44, wherein the chromatic-aberration compensation element is a convex diffractive lens and forms converging light in cooperation with the objective lens.

48. (Previously Presented) The optical head of claim 52, wherein the plurality of wavelengths comprises a wavelength  $\lambda$  that satisfies substantially a relationship of  $0.35\mu\text{m} \leq \lambda \leq 0.44\mu\text{m}$ ;

wherein said at least one diffractive optical element is a chromatic-aberration compensation element for compensating chromatic aberration caused by an objective lens for focusing beams on an information recording medium.

49. (Original) The optical head according to claim 48, wherein the chromatic-aberration compensation element is formed on the objective lens.

50. (Original) The optical head according to claim 48, wherein the chromatic-aberration compensation element and the objective lens are driven together by an actuator.

51. (Original) The optical head according to claim 48, wherein the chromatic-

aberration compensation element is a convex diffractive lens and forms converging light in cooperation with the objective lens.

52. (Currently Amended) An optical head comprising:
- at least one light source for emitting beams with a plurality of wavelengths;
  - a photodetector; and
  - at least one diffractive optical element provided in an optical path common to the beams with different wavelengths,
    - wherein a first diffraction light and a second diffraction light are substantially different in diffraction order and are emitted from the at least one diffraction optical element with respect to the beams with a plurality of wavelengths, wherein the diffraction orders of both the first diffraction light and the second diffraction light is not zero.
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